The Examiner states that the configuration of Claims 30-97 does not correspond to the disclosure of the drawings. In particular, it is stated that FIG. 1 does not show a pulse generator, a modulator, and a frequency selector, such as recited in Claim 31. It is also stated that the specification fails to discuss the claimed subject matter as recited in Claim 31.

The proposed amendments faxed to the Examiner on 03/26/2003 and 04/02/2003 point out that the functional descriptions of the components shown in FIG. 1, which are supported by the specification, are recited in Claims 30-97. Furthermore, proposed amendments to the specification (which were made to better support the terminology used in the Claims) outlined in the faxes were also shown to be supported by the original disclosure.

3. **In accordance with the Examiner's request, Applicant proposes an amendment to the Specification suggested in the Proposed Amendment faxed on 03/26/2003. The proposed amendment to the Specification is provided to address the Examiner's rejection of the Claims based on the deficiency of the Specification to describe subject matter in such a way as to enable one skilled in the art to make and/or use the claimed invention.**

   In particular, the proposed amendment to the Specification clearly identifies the FSFC 100 as a pulse generator, the controller 114 as a modulator, and the AOM 107 and injection source 110, as well as filters described in the specification, as frequency selectors.

4. The rejection of the Claims 30-97 under 35 U.S.C 112 is noted. Accordingly, Claim 30 was amended to clarify that there is no difference between "a plurality of carrier signals" recited on lines 3 and 6. Claims 31-35 were similarly amended. In particular, the phrase "a plurality of the carrier signals" was changed to "the plurality of carrier signals". Claims 30-34 were amended to include an antecedent basis for the term

"pulse period". In the claims 33, 38, 54, 70, 71, 86, and 87, "the plurality of pulses" was changed to "the plurality of periodic pulses". Claim 2 was amended such that the phrase "the unmodulated pulses" was changed to "a plurality of unmodulated pulses". In Claim 32, the phrase "information-modulated pulses" was changed to "information-modulated periodic pulses" to provide a proper antecedent basis. Similarly, Claim 33 was amended to provide proper antecedent basis for the phrase "information-modulated periodic pulses". In Claims 36, 44, 52, 55, 60, 68, 71, 75, 76, 84, 87, 91, and 92, the term "carriers" was replaced with the term "carrier signals" to provide correct antecedent basis. This corrected problems noted with respect to the phrases "the carriers" and "the plurality of carrier". In claims 30, 31, 33, 39, 55, 82-85, 90, 91, and 94, the phrase "the pulses" was changed to "the periodic pulses" to provide a proper antecedent basis. Claims 54, 70, and 86 were amended to include an antecedent basis for the phrase "the coded information signals".

5. The Double Patenting objection is noted. Claim 34 was amended to include a modulator adapted to modulate the carrier signals and/or the periodic pulses. It is requested that, upon allowance of the claims, Claim 35 be removed.

6. The prior art made of record and not relied upon is noted. Applicant asserts that the prior art does not disclose Applicant's invention as recited in the claims.

In U.S. Pat. No. 4,471,399, the Pulse Generator 14 does not generate periodic pulses nor is it adapted to produce a plurality of carriers having equally spaced carrier frequencies. For example, on col. 11, lines 50-53, the carrier receiver responds to only a single frequency or to a pair of closely spaced frequencies when frequency shift key modulation is used. Consequently, there is no carrier-frequency selector, such as recited in the claims.

U.S. Pat. No. 5,079,437 relates to a power supply and does not relate to multi-carrier signal generation. Although a pulse generator and filter are shown, the filter is adapted only to reduce voltage ripple. For example, col. 2, line 64 to col. 3, line 2 states, "Filter 32 receives square wave output signal 36 from pulse width modulator 30 and converts it to an essentially constant voltage signal whose ripple, or variation in voltage, is insignificant compared to the

average voltage. The ripple is preferably less than one per cent of the average voltage to circuit 22, which will be 24 volts." Consequently, there is no carrier-frequency selector, such as recited in the claims.

U.S. Pat. No. 3,581,191 relates to radio-frequency spectrometers. It is stated that the prior art uses repetitive pulses with short duration and long repetition rates is employed to produce a wideband of closely spaced Fourier components. Thus, the wideband nature of these transmissions may encounter the same spectrum-control problems affecting ultra-wideband pulse radio, which is a problem in the prior art described within the present patent application. The '191 patent describes modulating an RF carrier with a pseudo-random sequence to produce a wide bandwidth of closely spaced sidebands (col. 2, lines 22-29 and col. 3, lines 37-54). It is well known that a given sequence length (duration) produces spectral lines having a frequency separation that is inversely proportional to the sequence length (col. 4, lines 4-8).

The '191 patent does not describe any frequency selector to select or remove any spectral components relative to any frequency band, such as recited in the claims. In fact, an example is illustrated in col. 4, lines 8-16 in which excess transmission bandwidth is employed.

U.S. Pat. No. 3,760,417 relates to radar jamming systems. The '417 patent does not describe generating a plurality of carriers via pulse generation, nor does it show or describe any frequency selector or filter for selecting a predetermined plurality of the carriers, such as recited in the claims.

U.S. Pat. No. 3,651.466 relates to a recording and signaling apparatus for vending machines. In the '466 patent, a radio frequency transmitter/receiver unit generates a carrier and then the carrier is modulated with pulses (col. 4, lines 29-35). Thus, the pulse generators are not used to generate the carriers, such as recited in the claims. Furthermore, the only filter described in the '466 patent is used in a receiver (col. 3, lines 32-47). Consequently, the '466 patent does not describe a signal generator that includes a frequency selector for selecting a plurality of carriers, such as recited in the claims.

Version with markings to show changes made to Specification

An optical processor for an antenna array 150 shown in FIG. 1 derives its operational characteristics from a pulse generator, such as a traveling-wave FSFC 100. The processor includes an injection source 110 for generating an optical transmit seed signal. The injection source 110 is optically coupled to the FSFC 100. The injection source 110 may use any type of light-emitting source to generate the transmit seed signal. In this embodiment, the injection source includes a laser source 112 and a laser source controller 114. The FSFC 100 includes a frequency-shifting device (such as an AOM 107) and a cavity-length adjustment device (such as a translation stage 109), which is controlled by a scan controller 149. The FSFC 100 may also include a gain medium (not shown). An optical-to-RF signal converter such as a heterodyne detection device 120, is optically coupled to the FSFC 100. The heterodyne detection device 120 includes an output-beam wavelength demultiplexer (such as a diffraction grating 122), a fiber optic array link 124, an optical reference source 121, a reference beam fiber optic link 123, and a photodiode array 126 comprised of a plurality of photodiodes. A transmit/receive coupler array 130 connects the antenna array 150 to the photodiode array 126 and to an RF-to-optical signal converter 142 inside an optical receiver network 140. The RF-to-optical signal converter 142 is coupled to the FSFC 100 via an optical beam combiner 144. The optical receiver network 140 also includes a receive-beam wavelength demultiplexer, such as receiver diffraction grating 146, coupled to the FSFC 100. The receiver diffraction grating 146 is also optically coupled to a receiver 148.

Version with markings to show changes made to Specification

The laser source 112 may be any type of laser-beam generator that can provide beam intensities sufficient for operation of the processor as described in this application and may include more than one laser. The laser source is preferably a semiconductor laser. The laser source 112 emits an optical transmit seed signal that is coupled into the FSFC 100. For beam-forming applications, it is preferable that the transmit seed signal be a narrow-band signal. It is possible and in some cases preferable for the laser source 112 to emit multiple optical signals, each having a different frequency. Each frequency of the transmit seed signal emitted by the laser source 112 and coupled into the FSFC 100 is ultimately used to control at least one RF beam pattern radiated by the antenna array 150. The multiple optical signals may control multiple beam patterns and/or multiple sub-arrays of the antenna array 150. However, the embodiment of the array processor shown in FIG. 1 is used to describe how the processor functions with respect to a single frequency of light input into the FSFC 100. In this case, the laser source 112 is modulated by <u>a modulator, such as</u> the laser-source controller 114, at a data rate corresponding to an information signal to be transmitted. Various types of modulation may be used to produce a modulated transmit seed signal, such as AM, FM, PAM, PSK, FH, and time-offset modulation.

Version with markings to show changes made to Specification

A plot of a mode-locked output generated by the sum of ten equal-amplitude modes is shown in FIG. 2, and a plot of a mode-locked output produced by the interference between 50 equal-amplitude modes is illustrated in FIG. 3. Each mode has a frequency that equals the sum of a base frequency f_b and an integer multiple i ($i = 1,\ldots,N$) of an incremental separation frequency f_i. In the case where the FSFC 100 is the pulse generator used to generate the modes, the base frequency f_b may correspond to the optical transmit seed signal's frequency, and the separation frequency f_i may correspond to the shift frequency f_s of the AOM 107. In this case, the AOM 107 and the injection source 110 function as a frequency selector. In FIG. 2 and FIG. 3, the base and separation frequencies f_b and f_i have relative values of 1000 and .5, respectively, and have units of inverse time scaled by an arbitrary multiplier. The ten modes that comprise the pulses shown in FIG. 2 range in frequency from 1000.5 to 1005. The frequency spectrum occupied by the pulses shown in FIG. 3 includes 50 discreet frequencies in the range of 1000.5 to 1025. The pulses are essentially envelopes that enclose a signal that has a frequency that is approximately the value of f_b. The significance of this example is that it shows that modes can be selected from limited frequency spectrums to produce short time-domain pulses for CIMA.

Version with markings to show changes made to Specification

FIG. 6 is a plot of the spectral profile of a sequence of modes w(n) having incremental frequency spacing and amplitude tapering toward the edges of the sequence. All of the tapered window-filter techniques reduce sidelobes at the expense of increasing the main-lobe width. For example, the generalized Hanning window can be interpreted as a class of windows obtained as a weighted sum of a rectangular window and shifted versions of the rectangular window. The shifted versions add together to cancel the sidelobe structure at the expense of creating a broader main lobe. Some other types of tapered window sequences used in finite impulse response (FIR) filter design that are also applicable to the present invention include triangular (Bartlett), Hamming, Kaiser, Chebyshev, and Gaussian windows. In the case where the excitation distribution sequence w(n) is controlled within the FSFC 100 (for example, this would be done in an active FSFC 100, which contains a gain medium), a frequency-discrimination device may be used, such as a thin etalon (not shown) or an optical filter (not shown), that provides variable attenuation with respect to wavelength. Also, a spatial filter (not shown) or mask (not shown) may be used inside the cavity 100 to attenuate certain frequencies of light relative to their spatial relationships inside the cavity 100. The optical-to-RF signal converter may use a window filter to taper the optical distribution input into the converter or taper the RF distribution of the RF signal output from the converter. Other window filters such as frequency-selective or spatially selective variable gain or other forms of amplitude control may be applied to signals after being coupled out of the cavity 100. <u>The term "frequency selector" may include any of the types of frequency-domain filters described herein.</u>

Version with markings to show changes made to Specification

The reference source 121 may include a narrow-band single-frequency optical signal source. This causes the radiative transmit signal S_{TXn} to be incremental in frequency with respect to index n and the shift frequency f_s. This type of radiative transmit signal generates time-domain pulses by utilizing carrier interference multiple access (CIMA), a type of spread spectrum that makes use of interference between multiple carrier signals to create an information signal. This particular type of CIMA is similar to mode locking in that mode-like carrier signals having incremental frequencies are phase locked to produce constructive interference within a given time interval, resulting in sinc-type pulses. <u>The FSFC (100) is one type of pulse generator that may be employed by the invention. The controller 114 is one type of modulator that may be used. The AOM 107 and injection source 110, as well as any filters (not shown), function as a frequency selector.</u> Although the system in FIG. 1 is shown as a preferred embodiment of the invention for generating CIMA signals, other types of RF systems as well as optical systems may be used to generate CIMA signals.